

Kepler receives National Air and Space Museum trophy

BY MICHELE JOHNSON



photo by NASM

General John "Jack" R. Dailey (center front right), director of the National Air and Space Museum, presents the 2015 Current Achievement Trophy Award to William Borucki (center front left) and NASA's Kepler Mission Team.

The team in charge of NASA's Kepler Mission, responsible for history's first detection of Earth-sized planets orbiting other stars in their temperate "habitable zone," received the Smithsonian National Air and Space Museum's (NASM) highest group honor at a ceremony in Washington DC on March 25. Kepler received the 2015 Trophy for Current Achievement, which honors outstanding endeavors in the fields of aerospace science and technology.

Since its launch in March 2009, the Kepler mission has detected more than 4,000 candidate planets in orbit around other stars, or exoplanets for short. More than 1,000 of those exoplanet candidates have since been confirmed. These discoveries have revolutionized humanity's view of Earth's place in the universe by unveiling a whole new side of our Milky Way galaxy -- one that is teeming with planets.

As a result of Kepler's discoveries, scientists are confident that most stars have planets and that Earth's galaxy may host tens of billions of Earth-sized planets that reside in a

continued on page 8

SOFIA finds missing link between supernovae, planet formation

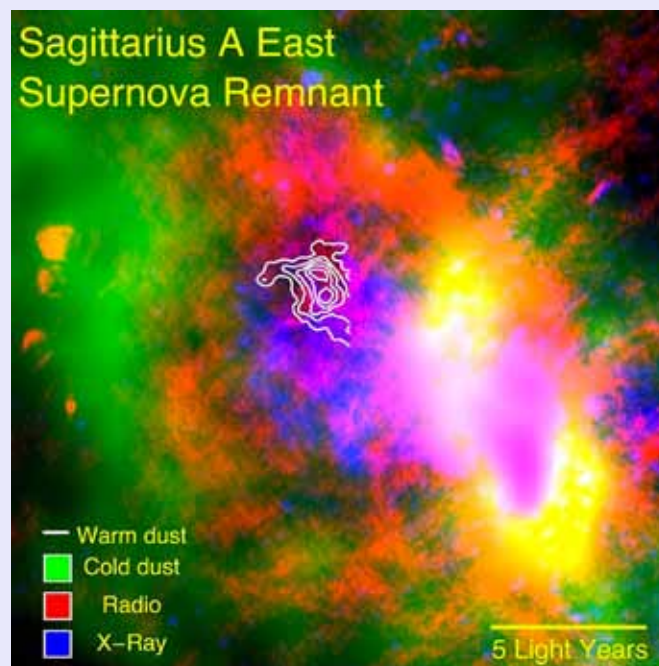
BY NICHOLAS VERONICO

Using NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA), an international scientific team discovered that supernovae are capable of producing a substantial amount of the material from which planets like Earth can form. These findings were published in the March 19 online issue of Science magazine.

"Our observations reveal a particular cloud produced by a supernova explosion 10,000 years ago contains enough dust to make 7,000 Earths," said Ryan Lau of Cornell University in Ithaca, New York.

The research team, headed by Lau, used SOFIA's airborne telescope and the Faint Object InfraRed Camera for the SOFIA Telescope, FORCAST, to take detailed infrared images of an interstellar dust cloud known as Supernova Remnant Sagittarius A East, or SNR Sgr A East.

continued on page 21



SOFIA data reveal warm dust (white) surviving inside a supernova remnant. The SNR Sgr A East cloud is traced in X-rays (blue). Radio emission (red) shows expanding shock waves colliding with surrounding interstellar clouds (green).

photo by NASA/CXO/Herschel/VLA/Lau et al

Ames launches science experiments to space station on SpaceX

NASA's Ames hosted a live televised launch viewing April 13, as two of the center's life science experiments were set to launch to the International Space Station. The sixth commercial cargo resupply flight of the SpaceX Dragon spacecraft carries Microbial Tracking-1B, which seeks to characterize airborne and surface microorganisms aboard the International Space Station and the first part of Rodent Research-2 evaluating muscle atrophy, eye structure and bone density changes in microgravity.

Three hundred registered guests had the opportunity to watch the launch at building 152 in the NASA Research Park. Those attending the event at the center spoke with scientists, engineers and researchers at informa-

tional booths (photos below) and heard guest lectures from the Ames space biosciences team as they discussed the life sciences payloads on the current mission, and the importance of the work

and research completed on the space station.

SpaceX's Falcon 9 rocket carrying its Dragon cargo spacecraft lifed off from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida April 14, 2015.

NASA photo by Donald Richey



NASA photo by Dominic Hart

Visitors at the center in B152 April 13 waiting to watch a live broadcast of a Falcon 9 rocket of SpaceX from Kennedy Space Center's Cape Canaveral. This mission carried two sciences payloads designed at Ames. The launch was delayed to the following day.

NASA photo by Dominic Hart

Ames Technology Transfer Awards ceremony held



NASA photos by Dominic Hart

Left photo: Acting Center Director Chuck Smith (left) presents David Kinney (center) and Loc Huynh (right) with a 2014 Western Region Federal Laboratory Consortium "Outstanding Commercialization Success" Award for their work on CBAERO: Configuration Based Aerodynamics during the recent 2014 Ames Technology Transfer Awards ceremony. The event honors those who won the NASA 2014 Software of the Year and the 2013 Government Invention of the Year awards, submitted and issued patents, authored articles for NASA Tech Briefs magazine, released software and/or were recognized by the NASA Inventions and Contributions Board or the Federal Laboratory Consortium.



Right photo: Gary Martin, Partnerships director, (standing far right) chats with Terry Fong and others at the 2014 Ames Technology Transfer Awards ceremony hosted by the center's Technology Partnerships Office, Code BT, and organized by Ames' Awards Liaison Officer, Robin Orans and Katie Smyth.

Advancements in thermal protection change game for Orion

BY MARIA ALBERTY

Just as old clunky ink jet printers from the 1990s evolved into today's state-of-the-art 3-D printers, thermal protection materials used on NASA spacecraft are getting a facelift--a major three-dimensional one.

Engineers used the original material, called two-dimensional carbon phenolic, in the past on the space

shuttle to protect it from the rocket flames during launch, on planetary exploration probes and on the 10-inch disc-shaped compression pads on NASA's Orion spacecraft, which flew in space on its first flight test in December 2014. But for Orion's next flight and on the journey to Mars, engineers have developed a more efficient material to

replace carbon phenolic called Three-Dimensional Multi-Functional Ablative Thermal Protection (3D-MAT).

The material was developed by NASA Ames in collaboration with Bally Ribbon Mills in Bally, Pennsylvania, and San Diego Composites in San Diego, California, for NASA's Space Technology Mission Directorate (STMD). STMD funded the incremental maturation of the novel technology from investigation of the basic concept through proof-of-concept performance testing in the severe thermal environment expected for Orion's future missions.

The pads are wedged between the crew module and the service module of Orion to support the extreme forces the crew module experiences on launch and ascent into space. Each pad supports approximately 55,000 pounds. That's the equivalent of withstanding the force of 16 elephants

jumping on Orion at the same time.

The discs also guard nearby parts of the crew module from explosive shock when the service module separates from the crew module, and they provide additional heat protection as the module streaks through the atmosphere, where the surface of the spacecraft's heat shield can reach

heating, keeping the structure and contents underneath, like astronauts, cool."

The difference between a 2-D and 3-D object is that a 2-D one only has length and width. 3-D objects have height as well as length and width. Thus, materials are weaved with fibers

not only length- and widthwise but also vertically (i.e., height) up and down through the length and width.

To make the material, 5,000 quartz fibers, each individually controlled, are woven together, making a 50-layer chunk stretching 13 inches long by 12 inches wide by 3 inches thick. The piece is injected with special glue to fill tiny pores between the fibers and layers, curing the material into its final masterpiece.

When the first samples of the

photo by NASA Ames

A Three-Dimensional Multi-Functional Ablative Thermal Protection (3D-MAT) sample after an arc jet test at NASA Ames. The sample shows the charred layer from the extremely hot, high pressured test; below the charred layer is unaffected 3D-MAT material.

temperatures greater than 4,000 F.

"Orion's second flight will have the spacecraft enter Earth's atmosphere at a much higher velocity than during its first flight, which means it will generate a lot more heat than pads made of carbon phenolic could withstand," said Jay Feldman, the technical lead for 3D-MAT, who works for ERC, Inc., at Ames.

Because carbon phenolic wasn't a solution for the second flight, engineers explored numerous other options including single-type or hybrid-type fibers, 2-D or 3-D techniques, weaving or layering and various gooeey resins.

"3-D weaves offer superior strength to 2-D weaves," Feldman explained. "The combination of quartz fibers--not carbon--and 3-D weaving gives 3D-MAT the robustness it needs to perform structurally. It is less massive and survives extremely high

material were completed, it was time to turn up the heat, and test them in Ames' Arc Jet facilities.

Arc jets simulate the extreme heat and pressure spacecraft experience when entering a planet's atmosphere at extreme speeds. The arc jets fire electricity at air particles so fast the particles turn into supersonic plasma. This gives engineers controlled test data on the ground before flight.

In arc jet tests of 3D-MAT, the material withstood impressively high heat fluctuations, temperatures and pressures -- consistently better than carbon phenolic, which cracked under the same conditions.

After three years of STMD funding, the team is ready to hand over their research and development efforts to the Orion program for its next mission's development and flight hardware.

continued on page 7

Simon P. (Pete) Worden, Ames Center Director, retires

BY KAREN BRADFORD

NASA Ames Center Director, Dr. Simon P. Worden (Brig. Gen., USAF, ret.) retired March 31, 2015 after more than 37 years with the government including more than eight years serving as center director at Ames. He came to Ames after retiring from the United States Air Force with more than 29 years of active service with his final position being the director of Development and Transformation, Space and Missile Systems Center, Air Force Space Command, Los Angeles Air Force Base, California.

During his time here, Worden completely transformed Ames, reinvigorating the center's workforce and taking a leadership role in important, cost-effective small satellite missions. Worden also put Ames on the critical path for all major NASA space exploration missions through effective use

of the center's unique wind tunnels, arc jets, intelligent systems and super-computer facilities and capabilities. In addition to leading key efforts in the sustainability area and partnerships both local, national and international as well as non-traditional, he also was named the 2009 Federal Laboratory Consortium's Laboratory Director the Year.

Worden is a recognized expert on space issues — both civil and military. He is looking forward to continued participation in space exploration and continuing to provide guidance and advice to those in this and the next generation. He also is very much looking forward to being able to spend more time with his wife Nancy, family and friends.



Center Director S. Pete Worden seen here during his final all hands at Ames, March 27, 2015 (photos left). During the all hands, he shared his thoughts about the bright future for the center as he closed out his tenure as director.



Colleagues and friends at Ames during the retirement luncheon, March 27, 2015 for Center Director S. Pete Worden.



NASA photos by Dominic Hart

Lewis (Lew) S. G. Braxton, deputy center director, retires

BY PHIL FLUEGEMANN

On Jan. 23 - 24, 2015, Lewis (Lew) S. G. Braxton III celebrated "40 Years of Achievement" at NASA Ames with more than 150 of his friends and colleagues from across NASA, with two special events, a retirement lunch at Ames (photos below) and retirement dinner.

Lew launched his NASA career as a co-op student accountant trainee at NASA's Dryden Flight Research Center. As he was planning on entering the private sector upon graduating from California State University, Fresno, Chuck McClinton, in the Ames Financial Management Division discovered Lew. Chuck went out of his way to recruit Lew to

NASA Ames. Lew said yes, launching his career at Ames.

His can-do attitude, strong work ethic and love of the Ames family enabled Lew to steadily climb up the management chain; evolving into an outstanding leader and spokesman.

Ames center director S. Pete Worden recognized Lew's capabilities in running the day-to-day operations, with a solid skill sets in finance, general management, strategic plan-

ning and policy selecting him as his deputy center director in 2008.

Lew closed out his career Jan. 31, 2015, serving as the second longest tenured Ames deputy center director.

Lew and Nonnie Braxton will continue their life journey in Rio Vista, California. In the near term, he plans to spend time with family, golf and reflection. Lew will be missed, but not forgotten.



Above photo: Lew Braxton, deputy center director (right) seen here during his retirement luncheon held at Ames Jan. 23, 2015.



NASA photos by Dominic Hart

Black History month colloquium with esteemed guests held



NASA photos by Dominic Hart



Left photo: Paul Henderson, deputy chief of staff and public safety director for the Mayor of the City of San Francisco and Judge Shelyna Brown, Santa Clara County Superior Court, responding to audience questions during the recent Black History month colloquium/panel held at Ames in February 2015. Reverend R.G Moore III, (above right photo) also was a member of the discussion panel during the event.



On Feb. 25, Ames hosted a Black History Month Colloquium featuring Paul Henderson, deputy chief of staff and Public Safety director for the Mayor of the City of San Francisco, Judge Shelyna Brown and Reverend R.G Moore III. The event began with an address by Henderson followed by a panel of all three guests.

Paul Henderson was appointed deputy chief of staff and Public Safety director by the Mayor of the City of San Francisco, Edwin M. Lee, in March 2011. In this posi-

tion, Henderson serves as a principal adviser to the Mayor. Henderson's service as chief administrator constitutes the highest-ranking position in the San Francisco District Attorney's Office ever held by either a LGBT or an African-American male attorney.

Judge Shelyna Brown was appointed by Governor Brown in 2011 and is one of the youngest members to join the Santa Clara County Superior Court Bench. Brown previously served as the supervising judge in Palo Alto and currently resides over criminal matters in San Jose.

Reverend R. G. Moore, III was licensed to preach the gospel at the age of 11 and ordained at the age of 17. He has preached in 15 of the 25 largest cities in the contiguous United States. He has been featured in human-interest stories by ABC, CBS and NBC news programs.

Wiseman discusses life on the ISS via social media



NASA photo by Dominic Hart

In February 2015, employees were invited to listen to astronaut G. Reid Wiseman (left) about life on the International Space Station and using communication to the public through social media. U.S. Navy Commander G. Reid Wiseman was a flight engineer on Expedition 41, which launched from Kazakhstan on May 28, 2014 onboard Soyuz 39. After more than five months in space, Wiseman returned to Earth, Nov. 9, 2014.

While in space, Wiseman conducted two space walks. During the first spacewalk, Wiseman and ESA astronaut Alexander Gerst permanently stowed a failed cooling pump module and installed the Mobile Transport Relay Assembly that provides power to the Mobile Transporter when moving between worksites. For the second spacewalk, Wiseman

and Gerst replaced a failed power regulator and prepped the station for a reconfiguration that will allow the station to accommodate future commercial crew vehicles.

Inside the space station, Wiseman and the Expedition 41 crew spent hundreds of hours conducting research in the areas of human physiology, medicine, physical science, Earth science and astrophysics including work on the Ames Rodent Research-1 experiment. Wiseman gained addition notoriety through his activities on social media. During his 165 days in space.

Wiseman fostered a strong social media following by sharing remarkable photos, personal tweets and short videos about life on the International Space Station. To follow Wiseman on twitter visit: https://twitter.com/astro_reid

Thermal protection change game for Orion

continued from page 3

"When we first started woven thermal protection systems technology, we felt it had the potential to significantly impact future NASA missions by changing heat shield development from a challenge to overcome into a mission-enabling component," said Ames' Ethiraj Venkatapathy, chief technologist for the Entry Systems and Technologies Division. "In less than 36 months, we are celebrating this technological achievement and delivering a highly developed, multi-functional material with superior performance to meet Orion's needs as well as to address the critical needs of NASA's journey to Mars."

Congressman Culberson tours Ames



NASA photo by Dominic Hart

Congressman John Culberson, Chairman, Commerce, Justice and Science Subcommittee, House Appropriations Committee visited NASA Ames Jan. 30, 2015. Here he's seen during his visit to the Hyperwall at the center.

NASA Ames Fellow Award Seminar honors Bill Borucki



Ames employees were invited to the NASA Ames Fellow Award Seminar, oil portrait unveiling, and reception honoring William "Bill" Borucki in February 2015. Borucki was inducted as an Ames Fellow in 2013 for his incredible career and contributions to science as the principle investigator for the Kepler Mission.

The Ames Fellow Program is

NASA and our research center. The rank of fellow is considered to be the highest recognition that Ames Research Center can bestow upon one of its own employees for research excellence.

During Borucki's career at Ames, he worked on the development of the heat shield for the Apollo Mission in the Hypersonic Free Flight



NASA photos by Dominic Hart

designed to identify and acknowledge a very small number of Ames Research Center employees for their national or international reputation of scientific or engineering excellence and their contributions to

Branch at Ames. After the successful moon landings, he transferred to the Theoretical Studies Branch where he investigated lightning activity in planetary atmospheres and developed mathematical models to predict the effects of nitric oxides and chlorofluoromethanes on Earth's ozone layer.

Currently, he is the science principal investigator for the Kepler Mission that uses transit photometry to observe over 100,000 stars and is designed to determine the frequency of terrestrial planets orbiting in and near the habitable zones of other stars. The colloquium was hosted by the Office of the Chief Scientist.

Kepler receives National Air and Space Museum trophy

continued from front page

distant star's "habitable zone," the region around a star where liquid water might exist on the surface of an orbiting planet. The Kepler mission also is establishing a foundation for future studies of exoplanet atmospheres that could eventually answer the question of whether or not we are alone in the universe.

The Kepler space telescope infers the existence of an exoplanet, by measuring the amount of starlight blocked when it passes or transits in front of its parent star. From these data, a planet's size in radius, orbital period in Earth years and the amount of heat energy received from the host star can be determined.

During its prime mission, Kepler simultaneously and continuously measured the brightness of more than 150,000 stars for four years, looking for the telltale dimming that would indicate the presence of an orbiting planet.

In May 2014, Kepler began a new mission, K2, to observe a series of fields along the ecliptic plane, the orbital path of the Earth about the sun, where the familiar constellations of the zodiac lie. This new mission provides scientists with an opportunity to search for even more exoplanets, as well as new opportunities to observe notable star clusters, young and old stars, active galaxies and supernovae. The

spacecraft continues to collect data in its new mission.

For a full listing of previous award-ees, along with a video about Kepler's award, visit: <http://airandspace.si.edu/events/trophy>.

NASA's Ames manages the Kepler and K2 missions for NASA's Science Mission Directorate. NASA's Jet Propulsion Laboratory in Pasadena, California, managed Kepler mission development. Ball Aerospace & Technologies Corp. operates the flight system with support from the Laboratory for Atmospheric and Space Physics at the University of Colorado in Boulder.

Tool enables citizen scientists to examine Asteroid Vesta

BY SHARON LOZANO

NASA has announced the release of Vesta Trek, a free, web-based application that provides detailed visualizations of Vesta, one of the largest asteroids in our solar system.

NASA's Dawn spacecraft studied Vesta from July 2011 to September 2012. Data gathered from multiple instruments aboard Dawn have been compiled into Vesta Trek's user-friendly set of tools, enabling citizen scientists and students to study the asteroid's features. The application includes:

- Interactive maps with the ability to overlay a growing range of data sets including topography, mineralogy, abundance of elements and geology, as well as analysis tools for measuring the diameters, heights and depths of surface features and more.

- 3-D printer-exportable topography so users can print physical models of Vesta's surface.

- Standard keyboard gaming controls to maneuver a first-person visualization of "flying" across the surface of the asteroid.

Vesta Trek was developed by NASA's Lunar Mapping and Modeling Project (LMMP), which provides mission planners, lunar scientists and the public with analysis and data visualization tools for our moon, spanning multiple instruments on multiple missions. Vesta Trek represents the first application of LMMP's capabilities to another world beyond the moon. LMMP-based portals for other worlds in our Solar System are currently in development.

"There's nothing like seeing something with your own eyes, but these types of detailed data-visualizations are the next best thing," said Kristen Erickson, director, Science Engagement and Partnerships at NASA Headquarters in Washington DC. "We're thrilled to release Vesta Trek to the citizen science community and the public, not only as a scientific tool, but as a portal to an immersive experience that, just by the nature of it, will allow a deeper understanding of Vesta and asteroids in general."

NASA's Dawn spacecraft is continuing its exploration in the asteroid belt, after arriving at the dwarf planet Ceres on March 6. As Dawn conducts its mapping and measurements of Ceres, LMMP will continue to work closely with the Dawn mission.



NASA photo

Screen capture of Vesta Trek application. Vesta Trek's interface allows explorers to fly around and even skim the surface of Vesta.

The Lunar Mapping and Modeling Project is managed by NASA's Solar System Exploration Research Virtual Institute, headquartered at NASA Ames. LMMP's development team is based at NASA's Jet Propulsion Laboratory in Pasadena, California. JPL also manages the Dawn mission for NASA. LMMP is funded by and

receives direction from the Planetary Science Division of NASA's Science Mission Directorate and the Advanced Exploration Systems program in NASA's Human Exploration and Operations Mission Directorate, at NASA Headquarters in Washington.

To explore Vesta Trek, visit: <http://vestatrek.jpl.nasa.gov/>

Lissauer receives H. Julian Allen award



NASA photo by Dominic Hart

Steve Zornetzer, acting deputy center director (left), presents Jack Lissauer (right) with the H. Julian Allen Award March 31, 2015. The award is truly one of NASA Ames Research Center's highest honors. In 2014, it was awarded to Lissauer for his paper "Models of Jupiter's growth incorporating thermal and hydrodynamic constraints." The Award was established in 1969 to annually recognize a scientific or engineering paper of outstanding technical merit and significance. Understanding the evolution of planets that are as massive as Jupiter gives information to the dynamic formation of our solar system and insights to extra-solar systems. This paper documents a body of work that contributes to NASA Ames pioneering research in planetary sciences. Lissauer has contributed greatly to our understanding of the development of Jupiter as a gas planet. His seminar he presented detailed the specifics of his award winning paper.

Partnership features Ames to aspiring scientists and engineers

BY MARIA C. LOPEZ

Not all students have the opportunity to visit NASA. However, the African American Advisory Group, (AAAG) and Hispanic Advisory Committee for Employees, (HACE) collaborated for an education-focused outreach initiative, the NASA Speaker Series, which was organized for the San Jose State University Mathematics Engineering Science Achievement (MESA) Schools Program.

MESA's mission is to enable educationally disadvantaged students to prepare for and graduate from a four-year college or university with a math-based degree in engineering, the sciences, business or mathematics. Through MESA, students develop academic and leadership skills, increase educational performance, and gain confidence in their ability to compete professionally.

The MESA program connects with students from 11 middle schools and high schools throughout the City of San Jose. This collaborative effort reached more than 420 students and 15 teachers, who participate in the MESA Program.

All of the students are considered disadvantaged, which includes being



George Gorospe, of Code TI, (center, eighth from left) with the Mathematics Engineering Science Achievement (MESA) students from Silver Creek High School.

photos courtesy of Silver Creek High and Joseph George Middle Schools

Speaker Series, "The AAAG is honored to support the MESA program in the development of the next generation of STEM leaders."

The SJSU MESA Schools Program director, Christina Ramos, also commended the NASA Speaker Series designed for MESA students, "NASA Ames' partnership with MESA has been invaluable. By providing access to speakers from within the federal

The NASA Speaker Series began in December 2014 and concluded in February 2015. The NASA guest speakers consisted of individuals from the Aeronautics Directorate, Information Technology Directorate, Science Directorate and the Exploration Technology Directorate. Each speaker presented their education and NASA experience as well as conducted a Q&A session. Additionally, every student and teacher received a NASA lithograph and a NASA decal to commemorate the special engagement.

The HACE chair, Jeanette Zamora-Ortega encapsulates this collaboration best, stating, "The Hispanic Advisory Committee for Employees is proud of all the individuals who took time out of their busy schedules to support this cause and we thank you for representing NASA Ames Research Center. We understand the complexity of rearranging your daily agenda to add an additional task, but at the end if one student is motivated to pursue a STEM career, just one, then it was all worthwhile."

The speakers definitely generated the interest of more than one student as many students voiced their interest in STEM and curiosity for NASA. Specifically, the MESA students at Joseph George Middle School extended their joint and sincere gratitude stating, "Dr. Enid J. Contés sparked our interest in STEM majors by showing us that success will never be accomplished without hard work, failures, and sacrifices in life. Thank you Dr. Contés for being a role model to us!"



Dr. Enid J. Contés, of Code SCB, (center, sixth from left) with the MESA students from Joseph George Middle School.

the first in their family to go to college, being low-income, or being in an underrepresented Science, Technology, Engineering, and Math, or STEM, group. Aisha Bowe, the AAAG chair and a champion for MESA, acclaimed the MESA Program and the NASA

research center, the AAAG and HACE have provided an inspiration to our students who are looking for role models in STEM fields. Notably, these speakers are shaping young minds and helping to strengthen the pipeline of future scientists and engineers."

NASA Ames reproduces the building blocks of life in laboratory

BY RUTH DASSO MARLAIRE

NASA scientists studying the origin of life have reproduced uracil, cytosine and thymine, three key components of our hereditary material, in the laboratory. They discovered that an ice sample containing pyrimidine exposed to ultraviolet radiation under space-like conditions produces these essential ingredients of life.

Pyrimidine is a ring-shaped molecule made up of carbon and nitrogen and is the central structure for uracil, cytosine and thymine, which are all three part of a genetic code found in ribonucleic (RNA) and deoxyribonucleic acids (DNA). RNA and DNA are central to protein synthesis, but also have many other roles.

"We have demonstrated for the first time that we can make uracil, cytosine, and thymine, all three components of RNA and DNA, non-biologically in a laboratory under conditions found in space," said Michel Nuevo, research scientist at NASA Ames. "We are showing that these laboratory processes, which simulate conditions in outer space, can make several fundamental building blocks used by living organisms on Earth."

An ice sample is deposited on a cold (approximately -440 degrees Fahrenheit) substrate in a chamber, where it is irradiated with high-energy ultraviolet (UV) photons from a hydrogen lamp. The bombarding photons break chemical bonds in the ices and break down the ice's molecules into fragments that then recombine to form new compounds, such as uracil, cytosine and thymine.

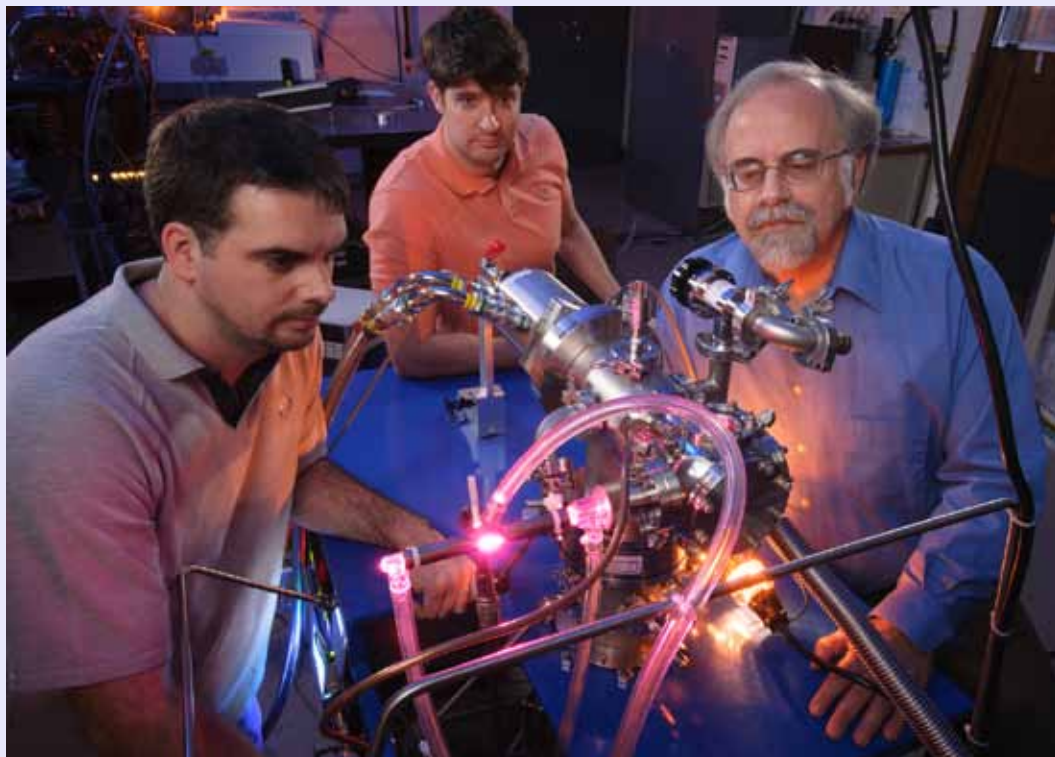
NASA Ames scientists have been simulating the environments found in interstellar space and the outer solar system for years. During this time, they have studied a class of carbon-rich compounds, called polycyclic aromatic hydrocarbons (PAHs), that have been identified in meteorites, and which are the most common carbon-rich compound observed in the universe. PAHs typically are structures

based on several six-carbon rings that resemble fused hexagons, or a piece of chicken wire.

The molecule pyrimidine is found in meteorites, although scientists still do not know its origin. It may be similar to the carbon-rich PAHs, in that it may be produced in the final outbursts of dying, giant red stars, or formed in dense clouds of interstellar gas and dust.

be able to shield themselves from destructive radiation. Once in the clouds, most molecules freeze onto dust grains (much like moisture in your breath condenses on a cold window during winter).

These clouds are dense enough to screen out much of the surrounding outside radiation of space, thereby providing some protection to the molecules inside the clouds.



NASA photo by Dominic Hart

Left to right: Ames scientists Michel Nuevo, Christopher Materese and Scott Sandford reproduce uracil, cytosine and thymine, three key components of our hereditary material, in the laboratory.

"Molecules like pyrimidine have nitrogen atoms in their ring structures, which makes them somewhat wimpy. As a less stable molecule, it is more susceptible to destruction by radiation, compared to its counterparts that don't have nitrogen," said Scott Sandford, a space science researcher at Ames. "We wanted to test whether pyrimidine can survive in space, and whether it can undergo reactions that turn it into more complicated organic species, such as the nucleobases uracil, cytosine, and thymine."

In theory, the researchers thought that if molecules of pyrimidine could survive long enough to migrate into interstellar dust clouds, they might

Scientists tested their hypotheses in the Ames Astrochemistry Laboratory. During their experiment, they exposed the ice sample containing pyrimidine to ultraviolet radiation under space-like conditions, including a very high vacuum, extremely low temperatures (approximately -440 degrees Fahrenheit), and harsh radiation.

They found that when pyrimidine is frozen in ice mostly consisting of water, but also ammonia, methanol, or methane, it is much less vulnerable to destruction by radiation than it would be if it were in the gas phase in open space. Instead of being destroyed, many of the molecules took on new

continued on page 24

Ames hosts NACA Centenary celebration at Mega Bites

Ames employees were invited to join the NASA family in celebration of the National Advisory Committee for Aeronautics (NACA) 100th Anniversary March 3, 2015 at Mega Bites, where the Ames Exchange served NACA-themed cakes.

ment, military and industry, began in an advisory role but saw the establishment of its first research and testing facility, the Langley Memorial Aeronautics Laboratory (Langley Research Center, Hampton, Virginia) in 1920. As the committee's role continued to

In 1958, at the beginning of the "Space Race" the four NACA aeronautics research laboratories and flight facilities, personnel and research activities were incorporated into the newly established National Aeronautics and Space Administration (NASA).



NASA photo by Donald Richey

Former Ames employees (above) who worked at Ames during the NACA era gathered March 3, 2015 to mark the 100th anniversary of the day Congress passed legislation establishing the NACA. Afterwards, they enjoyed a slice of birthday cake in the Cafe, sponsored by the Ames Exchange. Also to mark the day, Bill Warmbrodt of Code AV organized a barbeque in the parking lot near Cooper Loop where Ames aeronautics staff could honor their legacy in the research work of the NACA. Bill also managed to adorn the Center with hundreds of American flags to mark the NACA Centenary. Left to right: Kristine Clevenger, Hank Cole, Mary Boldt, Leroy Presley, Carolina Rudisel, Richard Kurkowski, George Cooper and Jack Boyd.

On March 3, 1915, Congress established the National Advisory Committee for Aeronautics "to supervise and direct the scientific study of the problems of flight with a view to their practical solution, and to determine the problems which should be experimentally attacked, and to discuss their solution and their application to practical questions."

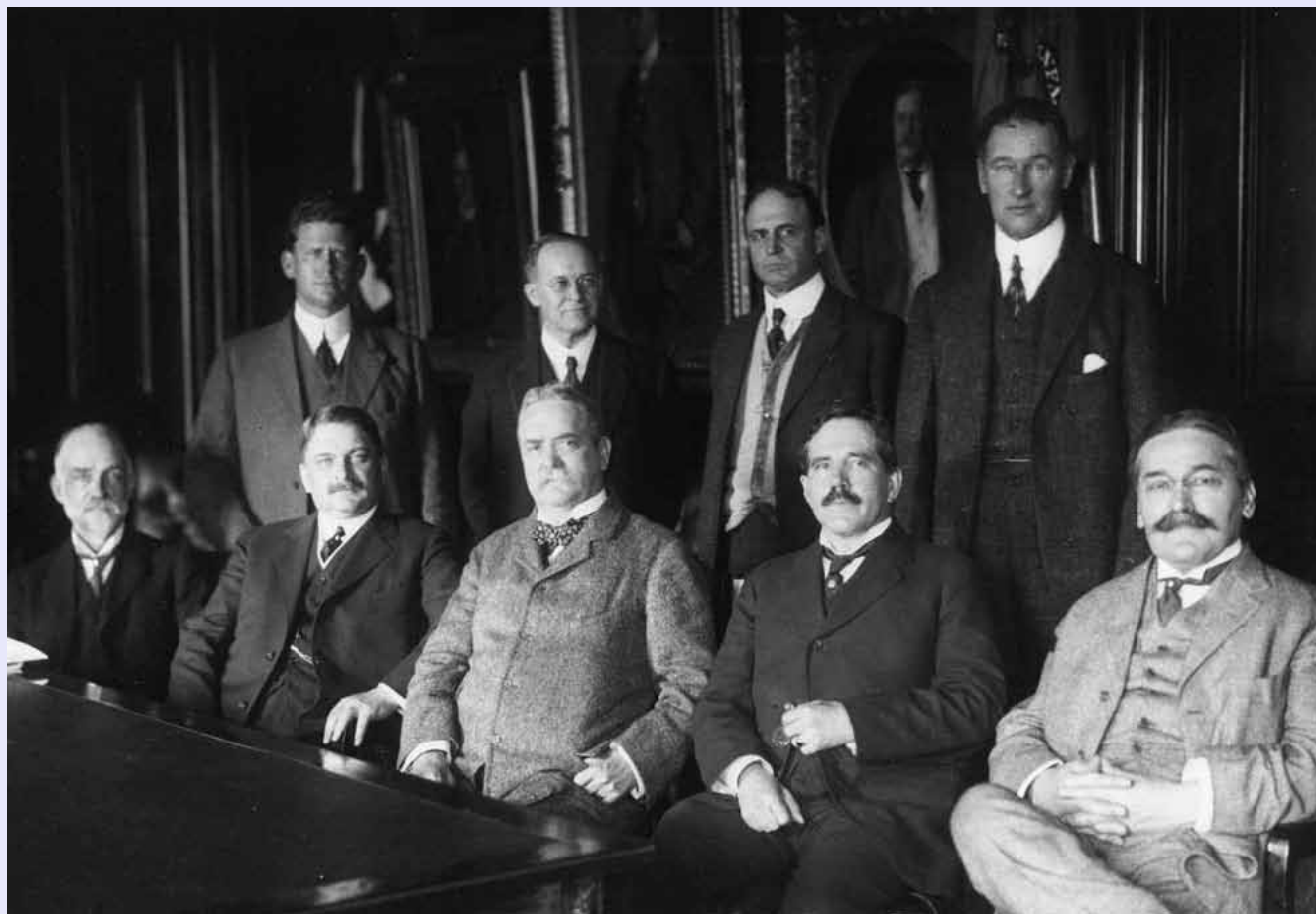
The 12 unpaid Main Committee members, representing the govern-

expand, the NACA added two additional facilities: the Ames Aeronautical Laboratory (Ames Research Center, Moffett Field, California) in 1939 and the Aircraft Engine Research Laboratory or Cleveland Laboratory (Glenn Research Center, Cleveland, Ohio) in 1941. A few years later, the Muruc Flight Test Unit (Armstrong Flight Research Center, Edwards Air Force Base, California) became the fourth NACA facility.

Today, the NACA legacy lives on at NASA Ames Research Center though the center's commitment to technical excellence and inter-agency cooperative approach to address the nation's complex scientific and engineering challenges.

For more information about NACA's 100th Anniversary, visit: <http://www.nasa.gov/naca100/>

First NACA meeting held April 23, 1915



NASA photo

The first meeting of the National Advisory Committee for Aeronautics (NACA) (above) was held April 23, 1915. The committee was civilian, though this meeting took place in the office of the Secretary of War, reflecting how the American military valued this new organization. After the Wright Brothers first flight in 1903, the United States fell behind in aeronautical research. With the beginning of World War I, the NACA was charged with catching up technologically with the European nations.

The NACA Main Committee was always at the heart of the organization. At first, they surveyed needs in aeronautical technology and contracted for the most pressing research. William Durand of

Stanford University, (shown seated on the far left in the above photo) built a small wind tunnel for the first parameter variation studies of propellor performance.

In 1920, the NACA opened its first laboratory at Langley Field and opened its second in 1939 at Moffett Field. For 43 years, the NACA worked to advance aerospace research until it formed the core of the new space agency, NASA, in 1958.

Seated from left to right: William Durand of Stanford University, (who was later a key advisor to the early leaders of the Ames Aeronautical Laboratory); Dr. Samuel Stratton, director of the Bureau of Standards; Brigadier General George P. Scriven, Chief Signal Officer of the War Department; Dr. Charles Marvin, chief of the U.S.

Weather Bureau; and Dr. Michael I. Pupin of Columbia University. Standing: (left to right) Holden C. Richardson, naval constructor; Dr. John F. Hayford, Northwestern University; Captain Mark L. Bristol, director of Naval Aeronautics; and Lt. Colonel Samuel Reber, Army Signal Corps and in charge of the aviation section. Also present at this first meeting, but not shown in the photograph, was Dr. Joseph S. Ames of Johns Hopkins University and the namesake of the NASA Ames Research Center.

Chawla's husband speaks at Ames Day of Remembrance ceremony

NASA held a Day of Remembrance Jan. 28, 2015, to reflect upon and celebrate the lives of the brave women

And we celebrate the courage of the crew of Columbia – Rick Husband, William McCool, Michael Anderson,

employees to reflect on those we've lost and the important role the Center has in supporting NASA's missions in

NASA photo by Dominic Hart



Jean-Pierre Harrison, the husband of Kalpana Chawla, reminisces about her and the rest of the Columbia crew during the Ames Day of Remembrance Ceremony, Jan. 28, 2015.

and men who gave their lives in the conduct of space missions in service to our country.

We recall with pride and sadness the pioneering crew of Apollo 1 -- Virgil "Gus" Grissom, Edward White and Roger Chaffee -- who died in a tragic fire on the pad on Jan. 27, 1967.

We also remember with great fondness the Challenger crew -- Michael J. Smith, Dick Scobee, Ronald McNair, Ellison Onizuka, Gregory Jarvis, Judith Resnick and Christa McAuliffe, the first "teacher in space," who perished just 73 seconds into their Jan. 28, 1986 flight.

Ilan Ramon, David Brown, Laurel Clark and Ames' own Kalpana Chawla -- friends and co-workers who we lost during a failed shuttle reentry on Feb. 1, 2003.

We also honor all others who have given their lives in the cause of space exploration. NASA Administrator Charles Bolden laid wreaths at the Tomb of the Unknown, and at the Challenger, Columbia and Apollo 1 memorials at the Arlington National Cemetery in Virginia to commemorate NASA's national Day of Remembrance and to honor our fallen colleagues.

Ames provided the opportunity for

the Syvertson Auditorium. Remarks were made by Chuck Smith, Ames Deputy Center Director (Acting), a video presentation about our fallen Ames and NASA colleagues was shown, as well as an observed moment of silence. Across the country, flags at NASA Headquarters in Washington and the NASA field centers were flown at half-staff in memory of the colleagues lost in the cause of exploration.

NASA photo by Dominic Hart



AA for Education returns to Ames

Donald James, formerly the director of Strategic Communications and Education Directorate, Code V at Ames and now the Associate Administrator of Education for NASA, visited the center in January 2015 conducting a workshop discussing the future of NASA education.

ORION nationwide “thank-you” tour visits Ames



NASA photos by Dominic Hart

In March 2015, Orion program leaders from NASA and Lockheed Martin recognized Ames researcher Jeremy Vander Kam (second from left) for his contributions to EFT-1 during their first stop on a nationwide “Thank you” tour to facilities that contributed to the success of Orion’s first test flight. Left to right: Mark Geyer, NASA Orion program manager; Jeremy Vander Kam, (Ames thermal protection system manager for Orion); Mark Kirasich, NASA Orion deputy program manager; and Mike Hawes, Lockheed Martin Orion program manager.

Right photo: Members of the Ames community who contributed to Orion’s first test flight pose with Orion program leadership and a banner signed by hundreds of Ames employees in support of EFT-1.



NRP recognized as 2015 Harvard Ash Center Bright Idea in Government



NASA photo by Dominic Hart

The Ash Center for Democratic Governance and Innovation at the John F. Kennedy School of Government, Harvard University, recognized NASA Research Park (NRP) as part of the 2015 Bright Ideas program. Above photo is an aerial view of NRP. The NRP is a world-class, shared-use R&D and education campus for industry, academia, non-profits, and government, a center for innovation and entrepreneurship with a unique community of scientists, engineers, students and educators with a shared mission. For more information about the award, visit: <http://www.ash.harvard.edu/Home/News-Events/Press-Releases/Harvard-s-Ash-Center-Announces-124-Bright-Ideas-in-Government> For more information about the NASA Research Park, visit: <http://www.nasa.gov/centers/ames/researchpark/home/index.html>

Hubble hits quarter century milestone of amazing images

BY GLENN BUGOS

On April 24, 2015, the Hubble Space Telescope celebrated the 25th anniversary of its 1990 launch into low-Earth orbit. Hubble is massive, sized to fit the bay of the space shuttle orbiter, with a 2.4 meter mirror, and currently provides imaging and spectra at visible and near-infrared wavelengths. Hubble was the first of NASA's "Great Observatories"

idea of orbiting space telescopes in 1946 – more than a decade before the first satellite orbited the Earth. It was in the clean rooms of the Lockheed Martin Space and Missiles Company in Sunnyvale that the many intricate parts of the Hubble were carefully pieced together.

Bertram Bulkin, legendary Lockheed program manager, and his team finished system integration in



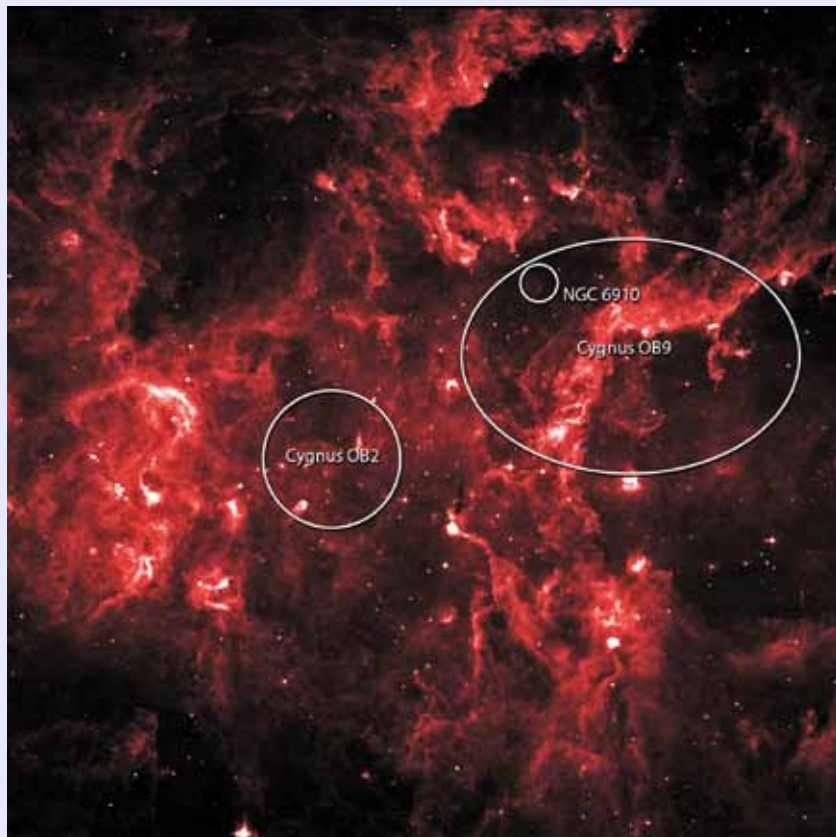
One of the first Ames researchers to serve as a principal investigator with observation time on the refurbished Hubble was Bob Rubin in 1993. Under his direction, the telescope was programmed weeks ahead to lock onto a star, offset from it and measure the gaseous amounts of chemical elements in the Orion Nebula, which was becoming the benchmark for the measurement of interstellar matter. Rubin used the data to determine the precise abundances of silicon, carbon, nitrogen and oxygen in the nebula, a region where stars are formed.

The Hubble is more sensitive than previous space-borne telescopes, and recorded spectral lines in the ultraviolet that would otherwise be absorbed by the Earth's atmosphere.

Hubble may well be remembered historically for spectacular imagery and its role in determining the size and shape of the universe. At Ames, Hubble has proven valuable in complementing and validating data from a range of other sources, notably from infrared telescopes. Hubble data on the formation of stars and nebulae has been a key component in supplementing Ames' work in astrochemistry.

In addition, planetary scientists at Ames over the decades have advanced our understanding of our solar system by relying on Hubble data -- like the crash of Comet Shoemaker-Levy 9 into Jupiter, the view of Saturn with its rings on edge in 1995, the discovery of tiny moons circling Uranus, and of weather patterns on Mars and Neptune.

The Hubble program office has created a website to feature events around its 25th anniversary: hubble25th.org



NASA photo

Ames astrochemists including Farid Salama and Lou Allamandola have long relied on data from the Hubble Space Telescope. In this image reddened stars with high dust abundances are embedded in the Cygnus OB2 dense cloud. From this observation target they obtained new spectra from the Hubble Space Telescope Imaging Spectrograph, in 1997 and in 2001, to search for structure in the ultraviolet interstellar extinction curve, with particular emphasis on a search for absorption features produced by polycyclic aromatic hydrocarbons (PAHs). Today Salama, for example, continues to search for the signature of organic molecules in the translucent clouds that represent a middle ground between the diffuse and dense interstellar medium, using the Cosmic Origins Spectrograph on the Hubble.

to launch and was followed by the Compton Gamma Ray Observatory, the Chandra X-Ray Observatory and the Spitzer Space Telescope.

It took many years for the Hubble to come to life. It represents the culmination of a dream of noted physicist Lyman Spitzer, who first proposed the

1986, though the Challenger disaster delayed launch until 1990. It was not until December 1993 that a crew of seven astronauts aboard STS-61 captured and repaired Hubble's flawed optics, transforming Hubble into one of the most important scientific tools in history.

How to train your astronauts, not such an easy task

BY MARIA ALBERTY

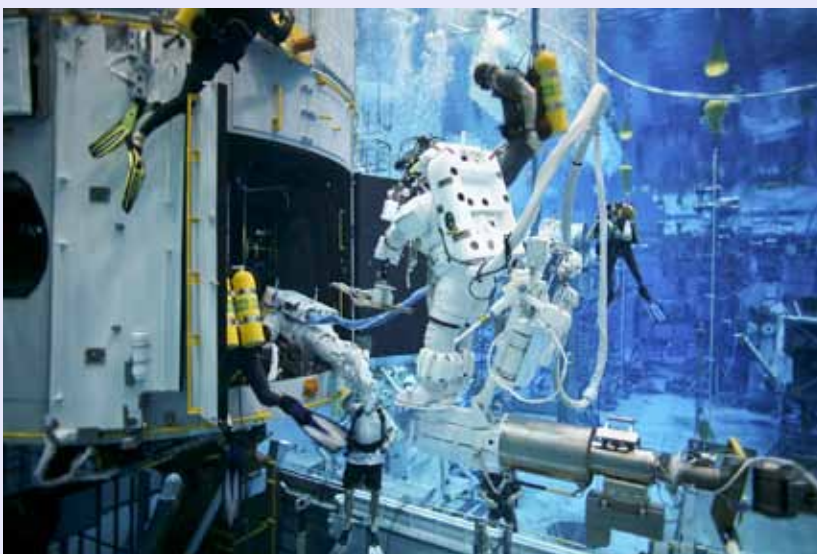
Training an astronaut is no easy task. Astronauts go through years of rigorous technical, health and safety training to learn simple and complex tasks for a typical four to six month mission. They develop skills in systems, robotics, spacecraft operations, space engineering activities and even learn Russian. As NASA develops deep space exploration missions on its journey to Mars, the agency is investigating current training methods in order to adapt to the longer and longer missions.

"During the shuttle program, astronauts trained about five to eight years for a 10 to 14 day mission, with a work-timeline scripted down to the minute," says Immanuel Barshi, a research psychologist from NASA Ames, in the Human Systems Integration division.

Decades of crew member research demonstrate that space can have adverse effects on people. Data suggests that the longer humans are in space, the greater the effects. On a trip to Mars, for instance, humans will be exposed to three years of micro-gravity and radiation; confined in an environment with three to five other people; separated from home; will experience altered day-night/light cycles; and will have three years to inevitably forget some of the training learned before leaving the planet.

Barshi's research, a study called Training Retention, examines to what extent these aspects of a Mars mission might affect a crew member's performance, as well as provide fresh insights into the way humans are trained for their jobs on Earth. Working with collaborators at NASA's Johnson Space Center in Houston, Barshi will study astronaut Scott Kelly's performance during his one-year mission aboard the International Space Station, in addition to that of other astronauts on six-month missions, and will compare results with astronauts on the ground over the same timeframe.

In conjunction with the Center for Research on Training at the University of Colorado in Boulder, Colorado, Barshi will compare the astronaut skill retention data from space and ground with that of undergraduate students. Much of what is known about how people learn and how well they retain information or skills is based upon university research. Such comparisons are critical to the application of ground assumptions to space operations, es-



NASA photo

Astronauts train in the Neutral Buoyancy Facility at the Johnson Space Center in Houston, Texas

pecially how the effects of long duration space travel affect crew members.

"Researchers know that skills retained for long periods are very specific, while generalizable skills decay much faster unless continuously practiced," says Barshi.

For example, a person can learn to enter the numbers 8675309 on a computer keypad extremely fast with excellent accuracy, and retain the skill for a long time. Ask them to do the same task, only this time using a different number sequence and the same person will be just as slow as another person who never practiced the original task. Meaning, it is the specific sequence of numbers that people remember, not the generalizable skill of entering any number.

Results from this study will not

only inform choices about astronaut pre-launch, on-board and follow-on training, but they may apply to training requirements for other professional careers. Currently, high risk industries, such as oil drillers, nuclear power plant operators, medical doctors and aircraft pilots or air traffic controllers, set training requirements based upon industry consensus and not necessarily specific research.

"Hopefully we will be able to distinguish whether a shorter interval or longer interval in training works and ask whether we are excessively training people with no added benefit or saved lives, but with added costs and inefficiency," said Barshi. "And to ask, even more importantly, are we are training people enough?"

Ames hosts media, social media event

BY JESSICA CULLER

NASA centers across the country opened their doors Feb. 2 to media and selected social media for "State of NASA" events, unique opportunities for a behind-the-scenes look at the agency's work on its journey to Mars. NASA's Ames hosted an event from 10:30 a.m. to 2:30 p.m.

Each center connected via NASA Television with NASA Administrator Charles Bolden at the agency's Kennedy Space Center in Florida.

Bolden addressed the agency's scientific and technological achieve-

ments and the exciting work ahead as we push farther into the solar system and lead the world in a new era of exploration. The briefing aired live on NASA TV and the agency's website.

Additionally, Ames hosted a preview of an exciting imaging mission later in the month, then an autonomy and robotics showcase, featuring experts and hardware at Ames' Roverscape. The showcase highlighted rovers, satellites and unmanned aerial systems (drones). Media interacted one-on-one with project researchers

continued on page 19

Micro-5: Investigation how pathogens cause disease

BY GIANINE M. FIGLIOZZI

Our guts literally teem with beneficial bacteria. But not all bacteria are harmless. Disease-causing bacteria, known as pathogens, can infect our intestines, causing illness or even death. Bacterial pathogens can contaminate the foods and beverages we consume

analog for the human body due to the many genes, biological functions and physiology that are common between humans and *C. elegans*, including a similar intestinal tract and aspects of the immune system.

"We are studying the entire host-pathogen interaction and infection

C. elegans and initiated live video monitoring, allowing researchers on the ground to track the survival of the roundworms in real-time.

Not only will the researchers compare the survival of roundworms that were infected in a weightless environment to those that remained in Earth's gravity, they also will analyze the effect of adding a chemical—phosphate—to the cultures to determine if this protects the worms from infection. They also will investigate the cellular, molecular and immune responses of both the roundworm host and *Salmonella* pathogen during the infection process to identify novel responses that may be important for disease progression. If this proves to be effective, then a similar approach may someday be used as a nutritional countermeasure to help protect humans from intestinal infections.

The crew collected samples of the infected cultures at specified time points and preserved them for post-flight analysis. Nickerson's science team performed identical operations on Earth at nearly the same time as the astronauts.

The preserved specimens returned to Earth with the SpaceX CRS-5 Dragon spacecraft on Feb. 10. Nickerson's team is analyzing these specimens for cellular, molecular and immune response changes to different experimental conditions. The findings will help shed light on the biological mechanisms by which changes in gravity affect the immune response, bacterial virulence and the complex interaction of a living host with an infectious pathogen.

Assessing the gut reactions of a few million roundworms will reveal new information about how gravity affects living systems, and will expand our knowledge of the bacterial infectious disease process both in microgravity and on Earth.

Space is an exciting frontier for biologists such as Nickerson who are studying how living organisms respond and adapt to the unique microgravity environment of the space station.

"Major advances in our knowledge of biological systems come when we study them in extreme environments," said Nickerson. "Spaceflight is the newest extreme environment available for biologists to explore."



NASA photo

Expedition 42 Flight Engineer Terry Virts sets up the Microgravity Science Glovebox for the Micro-5 experiments.

in our everyday diets, and illnesses caused by consuming tainted foods are a serious concern on Earth and in space.

NASA's Micro-5 investigation was launched to the International Space Station on Jan. 10, 2015, to help researchers gain a better understanding of how intestinal pathogens cause disease and how we can prevent or counteract foodborne illness in astronauts. Findings from the study also will help researchers develop novel strategies for preventing or treating intestinal infectious disease on Earth.

Tiny roundworms, whose even tinier intestines substituted for human guts in the study, were flown to the orbiting laboratory to become hosts to infection with a bacterial pathogen, *Salmonella Typhimurium*.

Salmonella, the leading cause of bacterial foodborne illness in the United States, can cause serious illness or death, and there is no vaccine to prevent *Salmonella* intestinal disease.

The roundworm used in the study—*Caenorhabditis elegans* (*C. elegans*)—is a widely studied biological research model, a scientific

process in microgravity and measuring virulence in real time," said Cheryl Nickerson, professor at the Biodesign Institute at Arizona State University, Tempe and principal investigator for the study.

Micro-5 is managed by the Space Biology Project at NASA Ames. Funding for Space Biology comes from the Space Life and Physical Sciences Research and Applications Division within the Human Exploration and Operations Mission Directorate at NASA Headquarters. BioServe Space Technologies, University of Colorado Boulder, developed and integrated the payload.

A previous study flown in space entitled *Microbe*, for which Nickerson also was the principal investigator, showed that *Salmonella* bacteria became more virulent—more capable of causing disease—when grown in space. This finding is particularly concerning as spaceflight also impairs human immune function, increasing the risk of infection for astronauts.

To perform the study, the station crew injected *Salmonella* bacteria grown in space into cultures of

Ames hosts media, social media for “State of NASA” events



Media visit during the “State of NASA” event at Ames, Feb. 2, 2015.

NASA photos by Dominic Hart



continued from page 17

and their cutting-edge technologies developed and under development, as NASA studies our changing Earth and the infinite universe, and progresses toward the next generation of air travel.

Following the showcase, agency Chief Financial Officer David Radzowski briefed media about NASA’s 2016 budget proposal in a teleconference with streamed visuals.

This briefing was followed by a local briefing on Ames elements of the

budget proposal with center leadership and Ames Chief Financial Officer Paul Agnew.

The NASA budget and supporting information are available online at: <http://www.nasa.gov/budget>



AA for Aeronautics gives ARMD update

Dr. Jaiwon Shin, Associate Administrator for Aeronautics, visited Ames April 8, 2015 to present an all-hands address to Ames employees. In his address, he provided an update about the ARMD budget roll-out and plans for the coming year. Shin also presented the ARMD Associate Administrator Awards to Ames recipients.

NASA photo by Dominic Hart

In Memoriam

Former Ames engineer Albert Garavaglia passes

Albert P. Garavaglia, age 93, passed away peacefully Nov. 24, 2014 in his home in Saratoga, California. He was preceded in death by his beloved wife, Grace, after 63 wonderful years of marriage. He is survived by his four children, Steven, Michael, Jane, Ronald and three grandchildren.

A veteran of WW2, Albert served in the Army Air Corps-7th Fighter Command Headquarters in Hawaii and later on Iwo Jima where many brave young men died securing and maintaining the airfield on that small island.

Albert studied engineering at San Jose State College and was first employed by NACA (later NASA) in 1948. He retired from NASA Ames Research Center's Engineering Branch in 1990 and holds U.S. Patent #282,738 for a Shoulder Harness and Lap Belt Restraint System he designed dur-

ing his employment. He also was involved with wind tunnel equipment design and operation. Albert truly loved airplanes and enjoyed closely following innovation in human flight and all of his work in the aeronautics field.

After retirement, Albert enjoyed painting and sketching in a style inspired by the greatest artists of the past. He dearly loved his family and in-laws and was proud when his daughter found work as a contractor in support of NASA at Moffett Field.

Albert's funeral was held at Darling-Fischer Chapel of the Hills in Los Gatos, California. Burial followed at Santa Clara Mission Cemetery, Santa Clara, Saint Joseph's Mausoleum.



Albert P. Garavaglia

Virginia Palumbo, former Ames computer resource manager, dies



Virginia I. Palumbo

NASA photo by Roger Brimmer

Virginia I. Palumbo, long-time member of the Central Computer Facility in Building N233, died at age 99 in Mountain View, California Jan. 20, 2015, after a very brief illness. She was born on July 30, 1915, in Brooklyn, New York, to Rosa and Eugenio

Palumbo and was the eldest of three children. She grew up in Brooklyn and attended Public School 186. Afterwards, she worked for Lerner's Department Store (now New York and Company).

In the 1940s, she left New York and moved to Fresno, California. There she was close to Yosemite, which she loved. She took visitors there often and said it was like a second home.

In the 1950s, she worked for the U. S. Army in Japan as a civilian. She left Japan after five years because, she said, "I was becoming more Japanese than American."

After a brief stay in the U.S., she went abroad again, this time as a civilian for the Air Force. She spent three years in Tripoli before returning to the U.S.

In the 1960s, she settled down in Mountain View, California, and started work at NASA Ames in 1963. She worked at Ames for 32 years until retiring in 1995, holding a variety of positions in computer operations and

computer resource management.

She loved working for NASA and even in her last days regretted that she had ever retired. To keep busy she made beaded necklaces and ornaments for local schools. She was devoted to her church and loyal to her friends—always remembering them on holidays and special occasions.

Virginia was preceded in death by her parents and by her two younger brothers: Pasquale, who died in a non-combat aircraft crash in 1944, and Nicholas (Nick), who died in 1980. She is survived by two nieces and a nephew, who live in Texas.

Services were held February 17, 2015, at St. Athanasius Catholic Church in Mountain View, California. Donations may be made to the St. Athanasius Church or the Yosemite Conservancy.

Former manager and engineer James Connolly dies

The Ames family notes with sadness the passing of James P. Connolly who died unexpectedly at his home in San Jose, Feb. 2, 2015. He was 76. To those privileged to work with Jim prior to his retirement in 2013, we lost a friend, mentor, phenomenal leader, gifted colleague and exceptional engineer.

Jim joined the Peace Corps in 1964, and spent two years working on road and building projects in Tanzania. He graduated from Santa Clara University with an masters degree in electrical engineering in 1972, while working full time at NASA.

During his 49-year career with NASA, Jim's talent for managing pioneering level technical and scientific research was surpassed only by his consistent ability to maintain an even keel. From Biocosmos to the space shuttle and the International Space Station, Jim led engineering and scientific efforts for innumerable NASA space flight missions.

In 1976, following his leadership of the successful Space Lab Mission Development Simulation, Jim led the Ames' Life Sciences hardware team that enabled advanced research on astronaut health during spaceflight. In 1982, he led the engineering team in developing space biology hardware and support equipment for a number

of shuttle middeck spaceflight experiments.

From the late 1980s through the late 1990s, Jim led the Ames Space Life Sciences engineering team working on SpaceLab Life Sciences 1, SpaceLab Life Sciences 2, the International Microgravity Laboratory, Spacelab Japan and finally the joint NASA/NIH Neurolab mission.

In addition to Jim's work on the shuttle/SpaceLabs, he also managed several joint US/Soviet biosatellite missions that provided US scientists with access to space when access was limited during the aftermath of the Challenger accident.

Later, Jim became the Project Management division chief, Code PX, at Ames. He provided leadership and mentoring to project managers on a variety of high visibility missions including the Stratospheric Observatory for Infrared Astronomy (SOFIA), Lunar Atmosphere and Dust Environment Explorer (LADEE), Lunar Crater Observation and Sensing Satellite (LCROSS), Interface Region Imaging Spectrograph (IRIS) and the Kepler Mission. NASA and Ames are simply better for the investment of Jim's long, dedicated and exemplary NASA career.

He is survived by his loving wife Sharon L. Connolly, who works in the



James Connolly

Acquisition Division at Ames, his son Tim, Tim's wife Susan and their son, Liam; his son Thad; his son Michael Sommese, Michael's wife Lucille and their children Quinn and Harper; also by his sisters Virginia, of Eureka, California and Jeanette, of Carson City Nevada.

SOFIA finds missing link between supernovae, planet formation

continued from front page

The team used SOFIA data to estimate the total mass of dust in the cloud from the intensity of its emission. The investigation required measurements at long infrared wavelengths in order to peer through intervening interstellar clouds and detect the radiation emitted by the supernova dust.

Astronomers already had evidence that a supernova's outward-moving shock wave can produce significant amounts of dust. Until now, a key question was whether the new soot- and sand-like dust particles would survive the subsequent inward "rebound" shock wave generated when the first, outward-moving shock wave collides with surrounding interstellar gas and dust.

"The dust survived the later onslaught of shock waves from the su-

pernova explosion, and is now flowing into the interstellar medium where it can become part of the 'seed material' for new stars and planets," Lau explained.

These results also reveal the possibility that the vast amount of dust observed in distant young galaxies may have been made by supernova explosions of early massive stars, as no other known mechanism could have produced nearly as much dust.

"This discovery is a special feather in the cap for SOFIA, demonstrating how observations made within our own Milky Way galaxy can bear directly on our understanding of the evolution of galaxies billions of light years away," said Pamela Marcum, a SOFIA project scientist at Ames.

SOFIA is a heavily modified Boeing

747 Special Performance jetliner that carries a telescope with an effective diameter of 100 inches (2.5 meters) at altitudes of 39,000 to 45,000 feet (12 to 14 km). SOFIA is a joint project of NASA and the German Aerospace Center. The aircraft observatory is based at NASA's Armstrong Flight Research Center facility in Palmdale, California. NASA Ames is home to the SOFIA Science Center, which is managed by NASA in cooperation with the Universities Space Research Association in Columbia, Maryland, and the German SOFIA Institute at the University of Stuttgart.

For more information about SOFIA, visit: <http://www.nasa.gov/sofia>

Ames participates in Business Forum: Discover Global Markets



NASA photos by Dominic Hart

The Department of Commerce, with NASA Ames, conducted a Business forum at the Santa Clara Convention Center, in February 2015.

Organized by the U.S. Commercial Service, in cooperation with NASA, Discover Global Markets: Sustainable Solutions addresses the link between sustainability and global business opportunities.

In order to effectively compete in global markets, U.S. companies require specialized market knowledge and excellent contacts – the fundamental elements of this conference.

The forum addressed global opportunities in advanced transportation, clean energy, air, water, land and use and explored the link between planetary sustainability and global business

opportunities.

Assistant Secretary of Commerce for Global Markets, Arun Kumar, gave the welcome remarks and then Ames Center Director S. Pete Worden (left photo) delivered the opening plenary, entitled, "The Business Case for Sustainability: The view from NASA."

Fitness Center hosts open house tour of its facility



NASA photos by Dominic Hart

Ames' Fitness Center hosted an open house, (above photos) in January 2015, providing a tour of the gym and to introduce employees to group exercise instructors. Membership is free to employees and it doesn't matter if you're just starting out on a fitness program for the first time or are a seasoned gym member. A wide variety of fitness programs are available and an excellent staff to assist you in accomplishing your goals. The fitness center also offers a wide variety of aerobic equipment and free weight systems as well as numerous group classes, fitness assessments, organized weight loss programs, personal/group training, walking programs, walking clubs, monthly fun runs/walks, etc.

Ames ongoing monthly events calendar

African American Advisory Group (AAAG) Mtg., last Tuesday of each month, 12 - 1 p.m., Bldg. N-255, Rm. 101C. POC: AAAG Chair, Aisha Bowe, ext. 4-1016 and AAAG Vice Chair, Porsche Parker, ext. 4-0044.

Moffett Aikido Club, Monday and Wednesday evenings, 6:30 p.m., Bldg. 944. Aikido is a non-competitive, defensive martial art known as the "Way of Harmony." POC: Diane Pereda (650) 575-9070 or Robert Dean (650) 787-1007, email: mfaikido@aol.com

Ames Amateur Radio Club, third Thursday of each month, noon, N-T28 (across from N-255). POC: George Tucker, at ext. 4-2200.

Ames Bluegrass Club, every Tuesday from 11:30 a.m. to 1 p.m. in Bldg. 944. Players of all instruments and all levels are welcome, but we are particularly interested in experienced players willing to help improve the group's musical skills. POC: Bob Haberle at ext. 4-5494 or email: robert.m.haberle@nasa.gov

Ames Bocce Ball Club, Ames' newest Exchange-sponsored club is seeking members. POC: Mike Lindsay email: michael.c.lindsay@nasa.gov

Ames Bowling League, at Fourth Street Bowl in San Jose. Looking for teams of four for start of season, Sept. 4. Need regular and substitute bowlers. Thursdays starting at 6:15 p.m. For sign up questions: Michael Hom at ext. 4-0302 or Mina Cappuccio at ext. 4-1313.

Ames Contractor Council Mtg., first Wednesday of each month, 11 a.m., Bldg. N-200, Committee Room. POC: Herb Finger at ext. 4-6598.

Ames Federal Employees Union (AFEU) Mtg., third Wednesday of each month, noon, Bldg. N-204, Rm. 101. Guests welcome. Check for schedule changes at: <http://www.afeu.org>. POC: Paul K. Davis, ext. 4-5916.

Ames Golf Club, Members have the opportunity to play approximately 13 tournaments per year at a variety of 18-hole golf courses in the Bay and Monterey Area. POC: Barry Sullivan: Barry.T.Sullivan@nasa.gov.

Ames Green Team (formerly the Green Ames Working Group) meetings are held the first Tuesday of each month in Bldg. N-237, Rm. 101, from 10 - 11 a.m. Ames Environmental Management Division, ext. 4-5660. Web: <http://environmentalmanagement.arc.nasa.gov/reports/eo-13514.html>

The Hispanic Advisory Committee for Excellence (HACE) Mtg., first Thursday of each month, 11:30 a.m. - 12:30 p.m., Bldg. N-255, Rm. 101C. POC: Jeanette Zamora, jeanette.zamora-ortega-1@nasa.gov.

Ames Jazz Band Club, Bldg. 944, 5:30 p.m. - 7 p.m. POC: Ralph Bach, email: ralph.e.bach@nasa.gov

Jetstream Toastmasters, Mondays, 12 p.m. - 1 p.m., Bldg. N-262, Rm. 100. POC: Tim Steiger, ext. 4-0195, tim.steiger@nasa.gov. Web: <http://jetstream.freetoasthost.com>

Native American Advisory Committee (NAAC) Bi-Monthly Meeting, First Thursday of the month beginning March 5, 2015, 11:00 a.m. - 11:45 a.m. Building 19, Room 1096. For more information contact Anita Abrego at Anita.I.Abrego@nasa.gov, or by phone at ext. 4-2565.

Ames Nimble Knitters Club, every Monday at 11:30 a.m., Bldg. N-210, Rm. 141. POC: Diane Alexander at ext. 4-3140 or email diane.alexander-1@nasa.gov. All knitters and crocheters are welcome to attend and participate in our charity projects.

Ames Roller Hockey Club, meets daily from noon to 1 p.m. at rink on north end of the 80-foot-by-120-foot wind tunnel. Players should have experience skating and must wear protective equipment. POC: James Prunty, james.a.prunty@nasa.gov

Ames Safety Committee, third Thursday of each month, 10 a.m. - 11 a.m., Bldg. N-237, Rm. 200. POC: John Livacich, jlivacich@mail.arc.nasa.gov, ext. 4-3243.

Women's Influence Network (WIN), first Wednesday of each month, Bldg. N-232, Rm. 227, noon - 1:00 p.m., POC: Wendy Holforty, wendy.l.holforty@nasa.gov

Exchange Information

Information about products, services and opportunities provided to the employee and contractor community by the Ames Exchange Council. Visit our web site at: <http://exchange.arc.nasa.gov>

Beyond Galileo Gift Shop N-235 in the cafeteria, 8 a.m. - 2 p.m., ext. 4-6873

Visitor Center Gift Shop (Exploration Center), Tues-Fri, 10 a.m. - 4 p.m., Sat. - Sun, 12 - 4 p.m., ext. 4-5412

Remember to purchase your baby shower, birthday and holiday gifts at Ames' two gift shops!

Mega Bites Cafeteria N-235, 6 a.m. - 2 p.m., ext. 4-5969/Catering ext. 4-2161

Barcelona Café, Bldg. 3, 6:30 a.m. - 2 p.m., ext. 4-4948/Catering ext. 4-4948

See daily menus at: <http://exchange.arc.nasa.gov/cafe/menu.html>

Moffett Field Golf Club with 'Tee Minus One' Grill and Sports Bar. Catering available. Call (650) 603-8026. Extended Happy Hour Thursdays, \$5 and \$6 pitchers of beer starting at 4 p.m. - 8:30 p.m.

RV lots available. Call to reserve a space at (650) 254-1808.

Civilian/Contractors, \$50/mo; military \$25/mo

NASA Lodge (Bldg. 19) (650) 603-7100
Where to stay when you're too tired to drive home? What about the lodge?! Two types of rooms: Bldg. 19 (43 rooms), rate: \$65/night (\$5 ea add'l adult); Bldg. 583 A&B (150 rooms), rate: \$55/night (\$5 ea. add'l adult); B547 rate \$60/night (for large groups)

Ames Swim Center (N-109) (650) 603-8025

The swimming pool is now open. Hours of operation are as follows (lap swim only):

MWF 10 a.m. - 1 p.m.

MWF 3 p.m. - 6 p.m.

TTH 10 a.m. - 1 p.m.

TTH 4 p.m. - 7 p.m.

The pool is heated year round. The pool normally is available for lap swim, pool parties and special events. POC: Ryan Storms, pool manager (650) 603-8025. Memberships: single memberships: \$60/yr. Family memberships: \$80/yr. After purchasing a membership, there is an entrance fee: daily entrance fee - \$3/day or lap pass fee - \$50 for 20 uses. Platinum membership - \$380/yr. (no daily fee). Special events include military training, swim team events, kayak role practice, etc. The cost for special events is \$75/hr, or \$50/hr for military.

Exchange basketball gym is now open, Bldg. 2 (650) 603-9717

Hours of operation:

M-F 11 a.m. - 1:30 p.m.

M-F 4 p.m. - 7 p.m.

Chase Park reservations, call ext. 4-4948
NACA Park reservations, call ext. 4-4948

Ames Cat Network

The Ames Cat Network needs help finding homes for cats trapped at Moffett. They range from feral to abandoned/lost pets. They are tested, altered and inoculated. Call Iris at ext. 4-5824 if you or someone you know are interested in fostering or adopting a cat.

Ames emergency announcements

To hear the centerwide status recording, call (650) 604-9999 for information announcements and emergency instructions for Ames employees. You also may listen to 1700 KHz AM radio for the same information.

Building blocks of life

continued from page 11

forms, such as the RNA/DNA components uracil, cytosine and thymine, which are found in the genetic make-up of all living organisms on Earth.

"We are trying to address the mechanisms in space that are forming these molecules. Considering what we produced in the laboratory, the chemistry of ice exposed to ultraviolet radiation may be an important linking step between what goes on in space and what fell to Earth early in its development," said Christopher Materese, another researcher at NASA Ames who has been working on these experiments.

"Nobody really understands how life got started on Earth. Our experiments suggest that once the Earth formed, many of the building blocks of life were likely present from the beginning. Since we are simulating universal astrophysical conditions, the same is likely wherever planets are formed," says Sandford.

Additional team members who helped perform some of the research are Jason Dworkin, Jamie Elsila, and Stefanie Milam, three NASA scientists at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

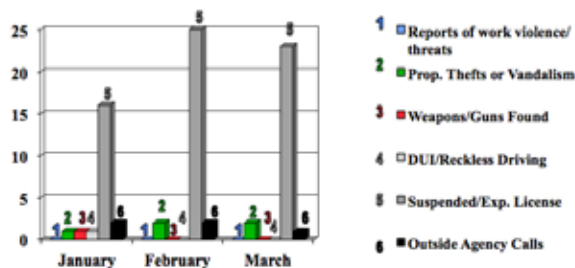
The research was funded by the NASA Astrobiology Institute (NAI) and the NASA Origins of Solar Systems Program. The NAI is a virtual, distributed organization of competitively-selected teams that integrates and funds astrobiology research and training programs in concert with the national and international science communities.



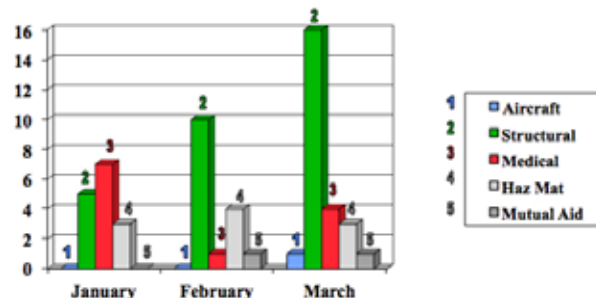
Protective Services monthly activity

A statistical summary of activities of the Protective Service Division's Security/Law Enforcement and Fire Protection Services units for the three-month period ending March 2015 is shown below.

**Protective Services Office – Activities
Security/Law Enforcement Monthly Activity Report**



**Protective Services Office – Activities
Fire Protection Services**



National Aeronautics and Space Administration

Ames Research Center
Moffett Field, CA 94035-1000



FIRST-CLASS
U.S. POSTAGE
PAID
PERMIT NO. 85
MOUNTAIN VIEW, CA

Astrogram NP-2015-04-01-ARC



The Ames Astrogram is an official publication of Ames Research Center, National Aeronautics and Space Administration.
Managing Editor.....Dolores Beasley
Editor, Layout and Design.....Astrid Albaugh
Employees can reach the Astrogram Office via email at: astrogram@mail.arc.nasa.gov or by phone at ext. 4-3347. For downloadable pdf copies of each issue, visit the Astrogram website at: <http://www.nasa.gov/ames/astrogram>



PLEASE RECYCLE
Printed on recycled and recyclable paper with vegetable-based ink.